

## ПУБЛИКАЦИИ 2019

### 1. **Заглавие** Iron oxidation effect on the Mg-Al-Si-O glassy system

**Автори** N. Ferreira, A. Sarabando, S. Atanasova-Vladimirova, R. Kukeva, R. Stoyanova, B. Ranguelov, F. Costa

**Резюме** Mg-Al-Si-O glassy systems have a great importance in a wide range of industrial applications, specifically as an electrolyte for molten oxide electrolysis processes in steelmaking. Understanding how the iron oxidation state of the raw material ( $\text{Fe}^{2+}/\text{Fe}^{3+}$ ) and its corresponding amount influence this glassy system's properties will be the aim of the current work. Iron oxides (as  $\text{Fe}_2\text{O}_3$  or  $\text{Fe}_3\text{O}_4$ ) were used to dope Mg-Al-Si-O system obtaining amorphous materials through an unconventional method: Laser Floating Zone (LFZ). Above 8% mol of Fe formation of magnetic phases or iron clusters, were observed in the glass matrix. Samples with  $\text{Fe}_2\text{O}_3$  showed a higher crystal concentration, when compared with  $\text{Fe}_3\text{O}_4$ . The electron paramagnetic resonance measurements show a strong dependence on the iron source ( $\text{Fe}_3\text{O}_4$  or  $\text{Fe}_2\text{O}_3$ ). In addition, the magnetization decreases linearly with iron content, independently of iron oxidation state, except for samples with a higher concentration of  $\text{Fe}_2\text{O}_3$  (15% mol), due to sample crystallization. Moreover, with  $\text{Fe}_3\text{O}_4$  as raw material there is an improvement (~250 times) of the electrical conductivity when compared with  $\text{Fe}_2\text{O}_3$ . The results show that the presence of  $\text{Fe}^{2+}$  on the glass influences the electrical conductivity, which could have impact in the efficiency of molten oxide electrolysis process.

**Списание** [Ceram Int 45 \(17\) A \(2019\) 21379](#)

### 2. **Заглавие** Origin of the heat-induced improvement of catalytic activity and stability of MnOx electrocatalysts for water oxidation

**Автори** M. Abrashev, P. Chernev, P. Kubella, M. Mohammadi, C. Pasquini, H. Dau, I. Zaharieva

**Резюме** Catalysis of the oxygen evolution reaction (OER) by earth-abundant materials in the near-neutral pH regime is of great interest as it is the key reaction for non-fossil fuel production. To address the pertinent stability problems and insufficiently understood structure–activity relations, we investigate the influence of moderate annealing (100–300 °C for 20 min) for two types of electrodeposited Mn oxide films with contrasting properties. Upon annealing, the originally inactive and structurally well-ordered Oxide 1 of birnessite type became as OER active as the non-heated Oxide 2, which has a highly disordered atomic structure. Oxide 2 also improved its activity upon heating, but more important is the stability improvement: the operation time increased by about two orders of magnitude (in 0.1 M KPi at pH 7). Aiming at atomistic understanding, electrochemical methods including quantitative analysis of impedance

spectra, X-ray spectroscopy (XANES and EXAFS), and adapted optical spectroscopies (infrared, UV-vis and Raman) identified structure–reactivity relations. Oxide structures featuring both di- $\mu$ -oxo bridged Mn ions and (close to) linear mono- $\mu$ -oxo  $\text{Mn}^{3+}$ –O– $\text{Mn}^{4+}$  connectivity seem to be a prerequisite for OER activity. The latter motif likely stabilizes  $\text{Mn}^{3+}$  ions at higher potentials and promotes electron/hole hopping, a feature related to electrical conductivity and reflected in the strongly accelerated rates of Mn oxidation and  $\text{O}_2$  formation. Poor charge mobility, which may result from a low level of  $\text{Mn}^{3+}$  ions at high potentials, likely promotes inactivation after prolonged operation. Oxide structures related to the perovskite-like  $\zeta$ - $\text{Mn}_2\text{O}_3$  were formed after the heating of Oxide 2 and could favour stabilization of Mn ions in oxidation states lower than +4. This rare phase was previously found only at high pressure (20 GPa) and temperature (1200 °C) and this is the first report where it was stable under ambient conditions.

Списание [J Mater Chem A 28\(7\) \(2019\) 17022](#)

**3. Заглавие** Optical anisotropy induced at five different wavelengths in azopolymer thin films: Kinetics and spectral dependence

**Автори** L. Nedelchev, D. Ivanov, B. Blagoeva, D. Nazarova

**Резюме** Azopolymers are highly efficient materials, able to register the polarization state of light. They have broad range of applications from diffractive optical elements with unique polarization properties to biophysics. We present a study of birefringence kinetics, induced with five different pump lasers with wavelengths 355, 442, 491, 514 and 532 nm in thin films of widely used amorphous azopolymer PAZO – poly[1-[4-(3-carboxy-4-hydroxyphenylazo)benzene sulfon amido]-1,2-ethanediyl, sodium salt]. During the real-time measurement, the value of the photoinduced birefringence ( $\Delta n$ ) is determined at 635 nm, using a DPSS laser. When saturation is reached, the spectrum of the birefringence is measured. Our results indicate that the investigated azopolymer can be used for applications in a wide wavelength range.

Списание [J Photochem Photobiol A: Chemistry 376 \(2019\) 1](#)

**4. Заглавие** Improvement of the photoinduced birefringence in azopolymer PAZO doped with  $\text{TiO}_2$  nanoparticles via thermal treatment

**Автори** G. Mateev, L. Nedelchev, A. Georgiev, D. Nazarova

**Резюме** We present a study of the photoinduced birefringence in nanocomposite films of the azopolymer PAZO (poly[1-[4-(3-carboxy-4-hydroxyphenylazo)benzenesulfon amido]-1,2-ethanediyl, sodium salt]) doped with  $\text{TiO}_2$  nanoparticles (NP) with different concentrations

before and after thermal annealing. The NP represent nanopowder with primary particle size 21 nm. The concentration of the NP was varied from 0% (non-doped azopolymer film) to 5 wt%. The thermal process, applied to the nanocomposite films, includes 1 h heating at 200°C. Previous studies of PAZO show that the polymer is stable up to 270°C. We study the dependence of the maximal birefringence induced with He-Cd laser ( $\lambda = 442$  nm) on the concentration of the TiO<sub>2</sub> NP in the azopolymer thin films as well as thermal effect on the absorbance spectra of the thin films. As indicated by our results, the birefringence is higher for the thermally annealed samples. An increase of the photoinduced birefringence is also observed for the nanocomposite layers with 1% NP for the non-annealed films, and with 2% NP for the annealed films.

Списание [Open Mater Sci 5 \(2019\) 19](#)

## **5. Заглавие** Optical Sensing of Humidity Using Polymer Top-Covered Bragg Stacks and Polymer/Metal Thin Film Structures

**Автори** К. Lazarova, D. Christova , R. Georgiev, B. Georgieva, T. Babeva

**Резюме** Thin films with nanometer thicknesses in the range 100–400 nm are prepared from double hydrophilic copolymers of complex branched structures containing poly(*N,N*-dimethyl acrylamide) and poly(ethylene oxide) blocks and are used as humidity sensitive media. Instead of using glass or opaque wafer for substrates, polymer thin films are deposited on Bragg stacks and thin (30 nm) sputtered Au–Pd films thus bringing color for the colorless polymer/glass system and enabling transmittance measurements for humidity sensing. All samples are characterized by transmittance measurements at different humidity levels in the range from 5% to 90% relative humidity. Additionally, the humidity induced color change is studied by calculating the color coordinates at different relative humidity using measured spectra of transmittance or reflectance. A special attention is paid to the selection of wavelength(s) of measurements and discriminating between different humidity levels when sensing is performed by measuring transmittance at fixed wavelengths. The influence of initial film thickness, sensor architecture, and measuring configuration on sensitivity is studied. The potential and advantages of using top covered Bragg stacks and polymer/metal thin film structures as humidity sensors with simple optical read-outs are demonstrated and discussed.

Списание [Nanomaterials 9 \(2019\) 875](#)

## **6. Заглавие** Temperature dependence of photoinduced birefringence in thin azopolymer films

**Автори** В. Blagoeva, G. Mateev, D. Nazarova, L. Nedelchev

**Резюме** In this work we study the dependence of the photoinduced birefringence on the initial temperature of the layer, as well as the possibility of recording and thermal erasure in thin azopolymer films. To determine the temperature dependence, the sample is placed on a hot stage, which can maintain or vary the temperature of the sample with a high precision. Birefringence is induced with a linearly polarized light from a laser at 442 nm, and its value is determined by measuring the Stokes parameters of a probe laser beam after the sample. The birefringence is erased by placing the sample on a hot stage.

**Списание** [J Phys Technol 3\(1\) \(2019\) 3](#)

## **7. Заглавие** Visualizing Healthy and Malignant Tissues via Polarized Light Imaging and Chemical Staining

**Автори** D. Ivanov, V. Strijkova, L. Nedelchev, D. Nazarova and E. Borisova

**Резюме** This study presents optical and chemical methods to visualize healthy and malignant sections of histological samples, by using polarized light imaging and staining with different contrast agents. This approach complements the diagnostic conclusions made by the physicians and improves qualitatively healthy versus tumor tissue differentiation, which may be in practical use for pathologists in their diagnostic conclusions.

**Списание** [J Phys Technol 3\(1\) \(2019\) 14](#)

## **8. Заглавие** Increase of the Photoinduced Birefringence in Azopolymer Films Doped with TiO<sub>2</sub> Nanoparticles

**Автори** G. Mateev, D. Nazarova, L. Nedelchev

**Резюме** In this article, we investigate the photoinduced birefringence in commercially available azo-polymer PAZO doped with TiO<sub>2</sub> spherical nanoparticles (21 nm size). The films are prepared by spin-coating water solution of the polymer mixed with the nanoparticles with different concentrations from 0 to 10 wt %. To induce the birefringence we use He-Cd laser with wavelength 442 nm. For measurement of the effect, probe laser with wavelength 635 nm is used. The experimental setup includes also polarimeter, which measures the Stokes parameters in real time. We observe increase of the photo-induced birefringence in azopolymer films doped with TiO<sub>2</sub> nanoparticles. The maximal value of  $n$  is achieved for the sample with 1 wt. % concentration.

**Списание** [J Phys Technol 3\(1\) \(2019\) 18](#)

**9. Заглавие** The Influence of Annealing on Optical and Humidity Sensing Properties of Poly (Vinyl Alcohol-Co-Vinyl Acetal) Thin Films

**Автори** K. Lazarova, S. Bozhilova, S. Ivanova, D. Christova, T. Babeva

**Резюме** Hydrophobically modified poly(vinyl alcohol)s of varied copolymer composition were tested as active media for optical sensing of humidity. Copolymer thin films were deposited on silicon substrate using water-methanol solution in a volume ratio of 20:80 and concentration of 1 wt%. Films were subjected to low (60 °C) and moderate (180 °C) temperature annealing in order to study the temperature influence on optical and humidity sensing properties. Refractive index, extinction coefficient along with thickness of the films were determined by non-linear minimization of the goal function comprising measured and calculated reflectance spectra at normal light incidence. The humidity sensing ability of the films was studied through reflectance measurements at different humidity levels in the range 5–95 %RH. The influence of temperature annealing on optical and sensing properties was demonstrated and discussed.

**Списание** [Proceedings 42\(1\) \(2020\) 16 \(ECSA-6 2019\)](#)

**10. Заглавие** Spray Pyrolysis as a Versatile Method for Advanced Materials Production. Basic Concepts and Available Applications (book chapter)

**Автори** S. Kozhukharov, V. Zhelev, S. Tchaoushev

**Книга** [Advanced Materials Science Research 37 \(2019\) 101-166, Ed. by M. Wythers, NOVA Sci. Publ. ISBN: 978-1-53615-038-4](#)

**11. Заглавие** Classical and Modern Methods for Corrosion Impact Rate Determination for Aluminium and Strengthened Aircraft Alloys. Fundamentals and Practical Applications (book chapter)

**Автори** S. Kozhukharov, C. Girginov

**Книга** [Phenomena and Theories in Corrosion Science. Methods of Prevention, 3-150 \(2019\), ed. By A. Gergely, NOVA Sci. Publ. ISBN 978-153-615253-1](#)